REMARKS

Claims 1, 3, 21 and 32 were amended. Claims 39-42 were added. After amending the claims as set forth above, claims 1-42 are now pending in this application. Non elected claims 32-35 were withdrawn from consideration. Applicants confirm election of Group I, claims 1-31 and 36-38 for prosecution on the merits. Support for amendment to claims 1, 21, 39 and 41 may be found on page 7, lines 4-6 and page 10, lines 16-20 of the specification. Support for claims 40 and 42 may be found, for example, in original claims 19 and 37.

I. Drawing objection should be withdrawn

The drawings were objected to because the drawings do not show at least two layers of TiO_2 particles in a silica layer. Applicants respectfully traverse this objection. Figure 7 shows the silica layer 56. Applicants submit that the TiO_2 particles in this silica layer 56 are sufficiently small as not to be visible in the scale of Figure 7. Thus, applicants submit that a drawing correction is not required. However, since a drawing correction was required in the Office Action to avoid abandonment of the application, Applicants enclose a corrected version of Figure 7 showing the TiO_2 particles in red.

II. Claim objection should be withdrawn

Claim 3 was objected to due to informalities. Claim 3 has been amended according to the examiner's helpful suggestion to overcome the objection.

III. Claim rejections over Shimizu should be withdrawn

Claims 1-14, 16 and 19-24 have been rejected under § 102(a and e) as being anticipated by Shimizu (U.S. Patent 6,069,440). Claims 15, 17, 18, 25 and 26 were rejected under § 103(a) over Shimizu. Claims 27-29 were rejected under § 103(a) over Shimizu in view of Jaffe and claim 30 was rejected under §

103(a) over Shimizu in view of Jaffe and Justel. These rejections are respectfully traversed.

Claim 1, as amended, recites that the radiation scattering material is located between the radiation source and the luminescent material and that the radiation scattering material comprises radiation scattering particles which are located separately from the luminescent material. Claim 21, as amended, recites that the phosphor or organic dye is located over and separately from the radiation scattering particles.

In contrast, Shimizu, col. 16, lines 50-52 teaches that dispersant particles are used together with the phosphor in the coating material 101 located above an LED. The radiation scattering particles of Shimizu are interspersed with the phosphor particles. Shimizu also teaches to put dispersant particles into the molding material 104 above the phosphor particles (col. 16, lines 62-66). Therefore, Shimizu does not anticipate claim 1 because Shimizu does not teach that dispersant (i.e., light scattering) particles are (a) located separately from the phosphor particles and does not teach that (b) the dispersant particles are located between the phosphor particles and the LED.[1] Likewise, Shimizu does not anticipate claim 21 because Shimizu does not teach that the phosphor or organic dye is located over and separately from the light scattering particles.[2]

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[1] Applicants note that claim 1 does not exclude a device in which luminescent (i.e., phosphor, etc.) particles are mixed with radiation scattering particles. However, claim 1 requires that at least some radiation scattering particles (a) are located separately from the luminescent material and (b) that these radiation scattering particles are located between the luminescent material and the radiation source. In contrast, new claim 39 excludes a device in which luminescent (i.e., phosphor, etc.) particles are mixed with radiation scattering particles.

[2] Applicants note that claim 21 does not exclude a device in which luminescent (i.e., phosphor, etc.) particles are mixed with radiation scattering particles. However, claim 21 requires that at least some phosphor or dye (a) is located separately from the radiation scattering particles and (b) that the phosphor or dye is located over the radiation scattering particles. In contrast, new claim 41 excludes a device in which phosphor or dye is mixed with radiation scattering particles.

Furthermore, the there is no motivation to separate the dispersant particles of Shimuzu from the phosphor particles or to locate the dispersant particles between the phosphor particles and the LED of Shimizu. In contrast, the present inventors have realized the benefit of locating the light scattering particles between a radiation source (i.e., LED) and the luminescent material (i.e., the phosphor). For example, the paragraph bridging pages 5-6 of the present specification states:

> The present inventors have realized that one of the causes of the halo effect is that due to the directional nature of the blue LED emission, a non-uniform source of blue light is incident on the phosphor layer. In contrast, in fluorescent lamps, a uniform source of UV energy is incident on the phosphor, which emits a fairly uniform white light. Therefore, in order to obtain a significant decrease in the halo and/or penumbra effects, the radiation scattering material is placed between the radiation source, such as an LED or a laser diode, and the luminescent material, such as a phosphor or a dye. The term "radiation" includes UV radiation as well as visible light, such as blue light. When the radiation scattering material is placed between the radiation source and the luminescent material, the radiation source radiation being scattered isotropically, is made substantially uniform and diffuse prior to being incident on the phosphor, similar to the uniform UV radiation source in the fluorescent lamp. Thus, the lamp emits white light with high far field color and intensity uniformity.

Thus, the location of the radiation scattering particles provides a significant benefit in reducing the halo and/or the penumbra effects and is not a "matter of routine design choice."

Applicants respectfully request withdrawal of the rejection of claims 1 and 21. Applicants submit that dependent claims 2-20 and 22-31 are in condition for allowance at least for the same reasons as claims 1 and 21, respectively.

IV. Claim rejections over Hohn should b withdrawn

Claims 35-37 were rejected under § 102(e) as being anticipated by Hohn (U.S. Patent 6,245,259). Applicants believe that there is a typo on page 7 of the Office Action and that claims 36-38 were actually rejected as being anticipated by Hohn. This rejection is respectfully traversed.

Claim 36 requires a luminescent material which does not exhibit Mie scattering and a phosphor which does exhibit Mie scattering. Therefore, if the luminescent material of claim 36 is a phosphor, then claim 36 requires phosphors with two different particles sizes.

In contrast, Hohn teaches a light emitting component having a single phosphor. This single phosphor is preferably a garnet phosphor, such as YAG:Ce. However, this single garnet phosphor has a single average particle size selected from a given range. Thus, Hohn does not teach or suggest that the YAG:Ce phosphor in the same light emitting component can have two different particle sizes.

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The Office Action refers to Col. 2, lines 15-26 and 33 and col. 3, line 44 of Hohn. However, these sections of Hohn describe the "luminous substance pigments" which are limited to the single YAG:Ce or another garnet type phosphor. Specifically, col. 2, lines 19-21 of Hohn states that the "luminous substance pigments" have a formula $A_3B_5X_{12}$:M (i.e., garnet type phosphor) while lines 22-26 describe the preferred grain size and diameter of the same garnet phosphor. Col. 2, line 33 of Hohn notes that the "luminous substance pigments" (i.e., the same garnet phosphor mentioned above) comprises between 0 and 25% of the encapsulating material of the light emitting component. Col. 3, line 44 of Hohn states that the inorganic luminous substance is YAG:Ce.

Thus, the portions of Hohn cited by the Office Action do not teach or suggest two phosphors with two different particle sizes. Furthermore, Hohn

does not teach or suggest one phosphor which exhibits Mie scattering and another phosphor which does not exhibit Mie scattering.

Claim 36 also recites that the radiation scattering phosphor layer is located between the radiation source and the luminescent material. Hohn does not teach or suggest this limitation. The Office Action asserts that YAG:Ce with two different particle sizes can be selected from the teaching of Hohn. However, even if the interpretation of Hohn in the Office Action is correct, Hohn does not teach or suggest forming a radiation scattering phosphor between a luminescent phosphor and the LED. Thus, even if Hohn teaches YAG:Ce phosphor with two different particle sizes, then these phosphors would be mixed together, rather than the Mie scattering phosphor being located between the non Mie scattering phosphor and the LED.

Applicants respectfully request withdrawal of the rejection of claim 36. Applicants submit that dependent claims 37-38 are in condition for allowance at least for the same reasons as claim 36.

IV. Claim rejections over Matsuda should be withdrawn

Claim 36 was rejected under § 102(e) as being anticipated by Matsuda (U.S. Patent 5,808,409). This rejection is respectfully traversed.

Claim 36 recites that the radiation scattering phosphor layer is located between the radiation source and the luminescent material. Matsuda does not teach or suggest this limitation.

Matsuda teaches a phosphor mixture of large transparent particles having a size of 0.5 to 20 microns, and ultrafine particles having a size less than 0.2 microns. In fact, as described in Col. 6, lines 29-30 of Matsuda, the ultrafine particles are attached to the large particles. Matsuda does not teach or suggest forming the large particles between the ultrafine particles and the radiation

source, as required by claim 36. Applicants respectfully request withdrawal of the rejection of claim 36.

VI. Claims 32-35

Non-elected claims 32-35 have been withdrawn from consideration. Claim 32 has been amended to include all limitations of claim 1.[3] Claim 32 was also amended to recite that blue light and ultraviolet radiation are both species of "radiation" in order to be consistent with claim 1 and with the definition of the term "radiation" on page 6, lines 8-9 of the specification. Applicants respectfully request that claim 32 be rejoined and placed in condition for allowance upon the allowance of claim 1, because claim 32 has the same or narrower scope than claim 1.

VII. Conclusion

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested. The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Date 9/25/02

Respectfully submitted,

By _____

Leon Radomsky
Registration No. 43,445

FOLEY & LARDNER
Customer Number: 22428
PATENT TRADEMARK OFFICE
Telephone: (202) 672-5300
Facsimile: (202) 672-5399

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

[3] Claim 1 generically recites a radiation source, while claim 32 recites a light emitting diode, which is a specie of radiation source genus. Thus, claim 32 is actually narrower than claim 1 in this respect.

MARKED UP VERSION SHOWING CHANGES MADE

1. (Amended) A light emitting device, comprising:

a radiation source;

a luminescent material; and

a radiation scattering material located between the radiation source and the luminescent material;

wherein the radiation scattering material comprises radiation scattering particles located separately from the luminescent material.

3. (Amended) The device of claim 2, wherein:

the radiation source comprises a blue or ultraviolet light emitting diode or laser diode; and

the luminescent material comprises a phosphor layer or a dispersion of [a] phosphor [and] in a transmissive encapsulating material.

21. (Amended) A white light emitting device, comprising:

a package containing a reflector cup;

a light emitting diode in the reflector cup;

radiation scattering particles in a packed layer or in a carrier medium over the light emitting diode; and

a phosphor or an organic dye which emits radiation having a second peak wavelength in response to incident light emitting diode radiation having a first peak wavelength, such that the device output appears white to an observer;

wherein the phosphor or organic dye is located over and separately from the radiation scattering particles located in the packed layer or in the carrier medium.

32. (Amended) A method of generating white light from a light emitting device, comprising a light emitting diode, a luminescent material, and a radiation

scattering material located between the light emitting diode and the luminescent material, wherein the radiation scattering material comprises radiation scattering particles located separately from the luminescent material, the method comprising:

supplying power to [a] the light emitting diode;

generating a directional radiation comprising blue light or ultraviolet radiation;

passing the [blue light or ultraviolet] directional radiation through the [a light or] radiation scattering material to diffuse the [blue light or ultraviolet] directional radiation in a plurality of directions;

providing the diffuse [blue light or ultraviolet] radiation comprising blue light or ultraviolet radiation onto [a] the luminescent material; and

generating white light.